



# Gilt Edge Mine Superfund Site

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY • REGION 8 • MAY 2008

## Proposed Plan for Public Comment

### Introduction

The public is invited to comment on this Proposed Plan to address environmental contamination at the Gilt Edge Mine Superfund Site. The Gilt Edge Mine is located in the northern Black Hills, near the towns of Deadwood and Lead, South Dakota. The U.S. Environmental Protection Agency (EPA) is issuing this Proposed Plan, in consultation with the South Dakota Department of Environment and Natural Resources (DENR), as required by Superfund law. This Proposed Plan provides an overview of the site history, contamination, and risk; summarizes the remedial alternatives that EPA is considering; and details EPA's preferred remedial alternative and supporting rationale.

**EPA's preferred remedial alternative includes storing acid rock drainage in the Anchor Hill Pit, upgrading the water treatment plant, removing, consolidating and covering mine waste, and providing for land use controls.**

*See the "Mark Your Calendar" section of this fact sheet to find out how to comment on the remedial alternatives presented in this plan.*

### Site Background

In 1986, Brohm Mining Company began large-scale, open-pit, cyanide heap-leach gold mining in a small mining district in the Black Hills where gold, copper, and tungsten had been mined intermittently since 1876. During its 13 years of operation, both EPA and DENR issued numerous notices against Brohm for permit violations and unpermitted releases causing contamination at the site.



In 1999, Brohm went bankrupt and abandoned the mine site, leaving 150 million gallons of acidic, heavy-metal-laden water in three open pits, as well as millions of cubic yards of acid-generating waste rock requiring cleanup and long-term treatment. DENR immediately assumed site maintenance and water treatment activities, and EPA initiated emergency response activities. In 2000, at the request of the Governor of South Dakota, EPA listed the Gilt Edge Mine site on the national list of Superfund sites, qualifying it for federal cleanup money.

To date, EPA and DENR have conducted three interim actions at the Gilt Edge Mine Site to protect human health and the environment in the short-term. In April 2001, EPA issued an interim Record of Decision and assumed authority over water treatment at the site to upgrade the water treatment plant and to treat contaminated water.

In August 2001, EPA issued another interim Record of Decision to begin remediating environmental contamination at the Ruby Gulch Waste Rock Dump. This significant source of site contamination is located in the east-central portion of the site. It covers 60 acres and contains an estimated 20 million tons of acid generating waste rock and spent ore. In November 2001, EPA issued a third Interim Record of Decision to modify the water treatment plant.

Due to the complex nature of this site, EPA has organized the work into three operable units. Operable Unit 1 (OU1) encompasses the environmental contamination across the primary mine disturbance area, including acid-generating waste rock and mine pits. Operable Unit 2 (OU2) includes site water treatment, groundwater contamination and lower Strawberry Creek. Operable Unit 3 (OU3) addresses the Ruby Gulch Waste Rock Dump.

This Proposed Plan describes the remedial alternatives proposed for OU1 which includes contaminant sources across the Gilt Edge Mine Site, but does not include OU2 and OU3. OU3 has been addressed as described above. OU2 has been addressed in the short-term as described above and EPA plans to develop long-term remedial alternatives for OU2 in the future.

Since 2000, EPA has conducted numerous site investigations, historical and technical data reviews, and pilot and treatability studies. EPA produced a Human Health Risk Assessment, an Ecological Risk Assessment, a Remedial Investigation Report, a Feasibility Study Report, and other important documents that provide key information in the development of the remedial alternatives presented in this Proposed Plan. ***Please see the Contacts section of this fact sheet to find out how to view any of this information.***

EPA and DENR communicated with area residents and stakeholders in a variety of ways throughout this process. Some of these activities include hosting public meetings and comment periods for the OU2 and OU3 interim actions; providing technical assistance grants to and working with local citi-

zen's groups; convening public meetings in 2005 regarding future use of the Gilt Edge site; and participating in various meetings, tours, and community interviews through the years.

## Site Characteristics

The 260-acre Gilt Edge Mine Superfund Site is located in mountainous terrain that gently slopes toward Bear Butte Creek, a tributary of the Belle Fourche River. The site is located in a rural area of Lawrence County, approximately four miles southeast of the town of Deadwood. Galena, an area located at the eastern boundary of the site, along Bear Butte Creek, is home to several dozen families. Numerous additional residences are dispersed in the general area around the site. Private land use in the vicinity of the mine site is primarily residential. The majority of the land within the site boundary consists of patented mining claims.

The Gilt Edge Mine site is located at the headwaters of three tributaries draining into Bear Butte Creek: Strawberry Creek, Terrible Gulch, and Ruby Gulch. Bear Butte Creek flows in part into the Madison aquifer, an important regional aquifer and the primary drinking water source for the town of Sturgis.

***The primary environmental problem at the Gilt Edge Mine site continues to be acid rock drainage (ARD). Commonly associated with mining sites, ARD is created when water comes into contact with highly mineralized rocks and soils that have been unearthed and exposed to air. This water becomes acidic, and the acid draws heavy metals from the rocks and soils through which it drains. The result is ARD: Highly acidic water carrying high levels of heavy metals.***

At the Gilt Edge Mine site, ARD is pervasive and must be captured and treated to minimize contamination of surface water and groundwater on-site and to prevent potential human health and ecological impacts off-site. Major surface water discharges from the site are being controlled or prevented via an interim ARD collection and conveyance system. And while ARD continues to infiltrate groundwater at the mine site, sampling shows

contaminated groundwater has not impacted off-site wells.

Should the current, interim collection and treatment of ARD fail, an uncontrolled release of ARD could flow off-site and could potentially contaminate the groundwater sources of nearby municipal water supplies and contaminate nearby streams.

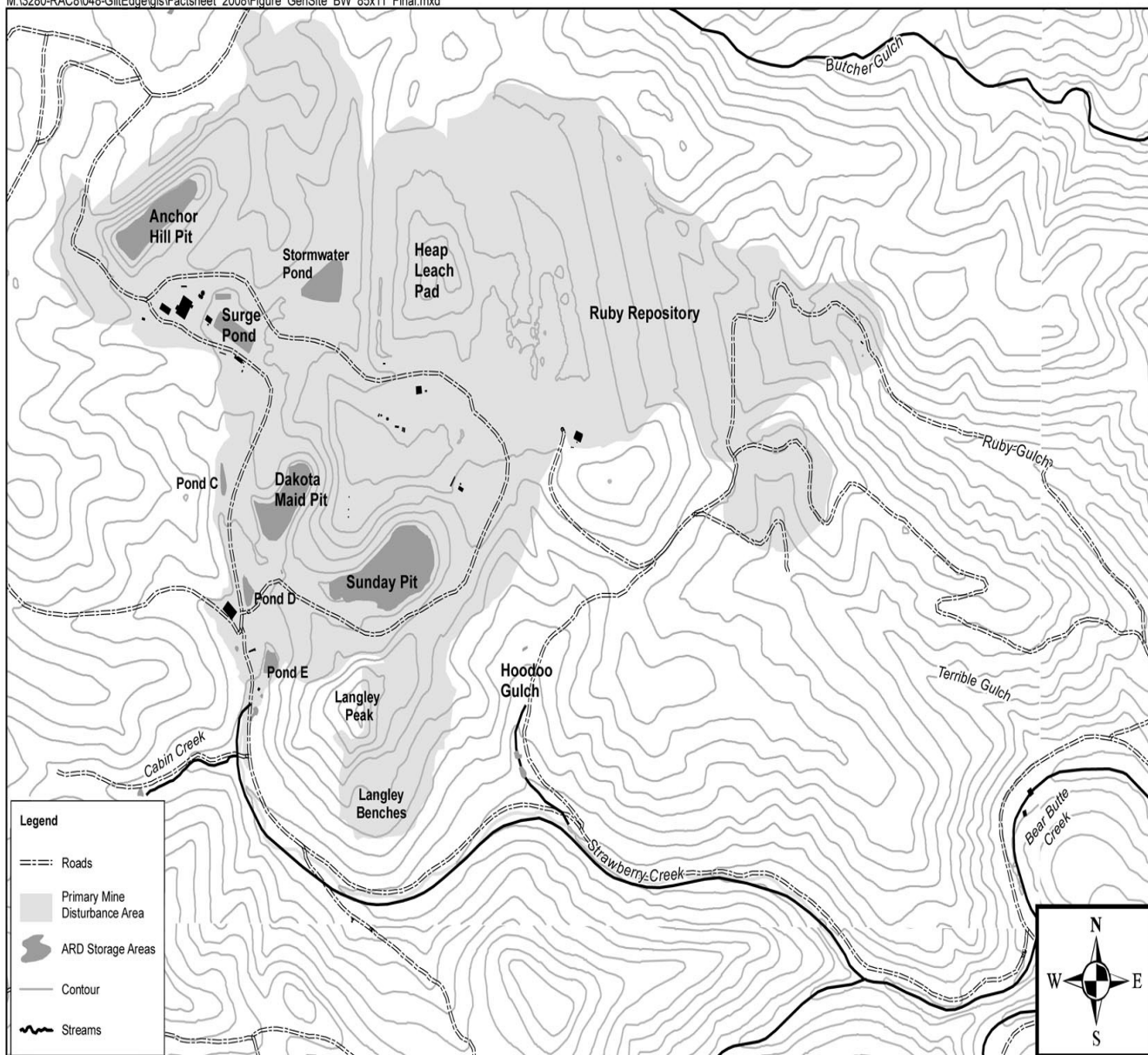
## Site Features

Significant features on the mine site, in addition to the collection, conveyance, and treatment facilities required to manage ARD, include underground

mine workings and large, open pits. Three of those pits, the Sunday Pit, Dakota Maid Pit, and Anchor Hill Pit are together nearly 65 acres in size and hold more than 100 million gallons of ARD. ARD runoff flows to numerous areas on the mine site. Currently, ARD is captured and stored in the pit lakes prior to treatment and discharge to Strawberry Creek.

The Heap Leach Pad is a notable feature on the site, located in the north-central portion of the mine area. It extends 37 acres and contains approximately 2.2 million cubic yards of spent ore, which is rock left behind from the gold leaching

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process. The Heap Leach Pad sits on a liner system which minimizes its impact to groundwater. Currently, ARD that is generated on the Heap Leach Pad is collected and pumped into the site water treatment system.

The Ruby Gulch Waste Rock Dump is another feature on the mine site that contributes to ARD runoff and heavy metal contamination at the site. Most of the Ruby Gulch Waste Rock Dump has been capped as part of the OU3 Record of Decision, and only a small portion of it will be capped as part of this proposed action for OU1.

There are other areas within OU1 with significant volumes of waste rock fill. These include the Hoodoo Gulch, Strawberry Gulch, Stormwater Pond, and Anchor Hill.

Another important mine waste feature on the site is relic tailings, which are mine wastes typically high in heavy metals that were produced at the site prior to 1942. Relic tailings are found in various locations across the site, including on the banks of Strawberry Creek.

Several of the mine features described above are also main sources of ARD and heavy metal contamination on the mine site. These sources include waste rock, spent ore, exposed rocks, underground mine workings, mine tailings, soil stockpiles, and sludge. These contaminant sources are widespread within the primary mine disturbance area.

## Summary of Site Risks

### Baseline Human Health Risk Assessment

EPA completed a Baseline Human Health Risk Assessment in 2001 to identify chemicals of potential concern to human health at the site. It also assessed the risk to people coming into contact with those chemicals in soil, groundwater, surface water, sediment, and fish tissue at the site. The Baseline Human Health Risk Assessment assumed that current site users include on-site workers and off-site fishermen and residents.

The assessment looked at potential future site users such as on-site residents, workers, and recrea-

tional visitors. The assessment concluded that human health risks are present for both current and potential future users in site soils, surface water, and groundwater. The risks vary depending on the specific site user, contaminant, and exposure unit.

These risks are driven by the following contaminants of concern: arsenic, manganese, and thallium in *surface soils*; aluminum, arsenic, cadmium, chromium, copper, iron, lead, manganese, thallium, and zinc in *surface water*; and aluminum, antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, thallium, and zinc in *groundwater*. As previously discussed, ARD is the key mechanism that releases these heavy metals from source materials and mobilizes them into surface water and groundwater.

### Baseline Ecological Risk Assessment

EPA completed a Baseline Ecological Risk Assessment in 2003 to assess the risks to non-humans from exposures to site contaminants. The evaluation considered impacts to fish and wildlife, water and soil-dwelling organisms, and vegetation from direct contact with contaminants in surface water, sediments, and soil.

The Baseline Ecological Risk Assessment concluded that direct contact with *surface water* in Strawberry Creek, Hoodoo Gulch, and Ruby Gulch poses both short-term and long-term risks in varying degrees to all groups of organisms. Risks associated with contaminants off-site in Bear Butte Creek surface water were not identified.

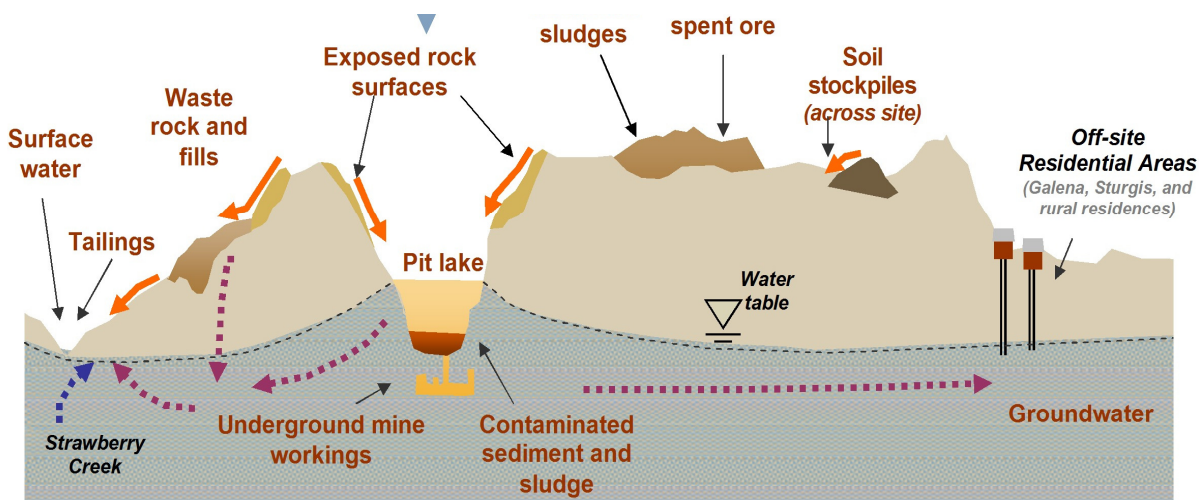
The assessment also concluded that organisms were being adversely impacted by contaminants in *sediments* in Strawberry Creek. Risks associated with sediments in Bear Butte Creek were evaluated and considered not significant.

Results show risks in *soil* from a variety of contaminants ranging from moderate to severe for plants and soil organisms in the Strawberry Creek riparian zone, and moderate to high in the Bear Butte Creek riparian zone. Risks were also present in soil at the mine area.

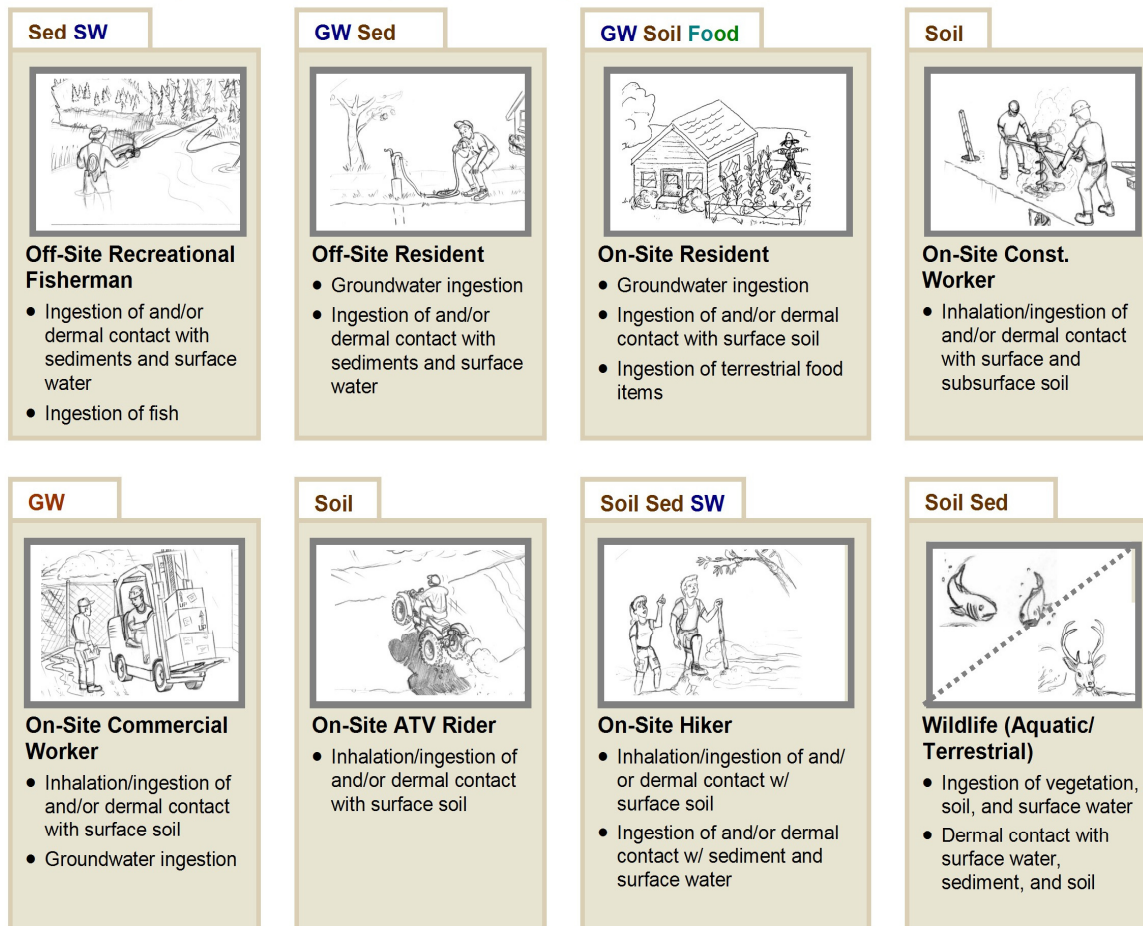
In addition, cadmium in Strawberry Creek poses a

# Site Conceptual Model

The site conceptual model incorporates the primary mechanisms that lead to the release of contaminants from source materials; migration routes of contaminants in the environment; exposure pathways and human/ecological receptors. In other words, who or what can be exposed and how.



## Potential Exposure Pathways and Receptors



severe risk to *fish*. *Wildlife* risks were above a level of concern in both Strawberry Creek and Ruby Gulch as a result of aluminum in surface water and a variety of other contaminants in soil and plants.

The Baseline Ecological Risk Assessment does not reflect the beneficial effect that recent, major remedial work has had on Strawberry Creek. That work included construction of a new water treatment plant (OU2) and the Ruby Repository and associated Ruby Toe groundwater collection system (OU3). EPA is evaluating the magnitude of ecological risks remaining at Strawberry Creek and planning for additional ecological monitoring.

*As there are significant risks to human health and the environment at this site, EPA believes that the Preferred Alternative presented in this Proposed Plan is necessary to protect human health and the environment. Contaminants at the site are threatening fish, wildlife, soil and water organisms, plants, and people, both on-site and off-site. Actual or threatened releases of contaminants in groundwater or surface water from this site could present an imminent and substantial danger to the water resources and fisheries of nearby communities.*

## Remedial Action Objectives

Remedial Action Objectives are goals developed by EPA to protect human health and the environment at the Gilt Edge Mine Site. These are the overarching goals that all cleanup activities selected for OU1 should strive to meet. EPA considers current and future use of the site when determining Remedial Action Objectives.

Based on current zoning of the Gilt Edge Mine Site, plausible future uses include low-density residential use. However, groundwater beneath the site is not suitable as a drinking water source without treatment. Further, steep features at the site are not conducive to residential development. EPA has determined that it is not realistic to remediate the site to meet residential use criteria because of these site conditions.

Future recreational activities at the site might include snowmobiling, cross-country skiing, ATV use, hiking, hunting, and fishing (within the Strawberry Creek drainage). However, in evaluating potential, future recreational activities at the site, the final condition of the remediated area must be considered. One of the primary methods to mitigate ARD is to limit infiltration of water into the source materials. Soil covers are an effective means for limiting water infiltration. Snowmobiling and ATV use could compromise soil covers. EPA has thus determined the reasonably anticipated future use of the site to be non-motorized activities.

**The following Preliminary Remedial Action Objectives for OU1 are based on anticipated future light-recreational and ecological use of the site:**

- \* Manage ARD source materials to reduce the volume of ARD that requires on-site treatment.**
- \* Reduce or eliminate the risk of an uncontrolled release of ARD from the site as a result of a 100-year, 24-hour storm event.**
- \* Ensure that low intensity recreational site users and commercial workers have no more than a 1 in 10,000 chance of contracting cancer from breathing or swallowing on-site soils.**
- \* Ensure that low intensity recreational site users and commercial workers are protected against non-cancer effects through surface soils. With contaminants that exceed a hazard index of greater than or equal to one.**
- \* Reduce risks to terrestrial ecological receptors through control of mine waste.**
- \* Implement institutional controls to prevent the unacceptable uses of groundwater that pose human or ecological risks.**
- \* Implement institutional controls that limit residential and off-road motorized vehicle rider use and allow only low intensity recreational site users and commercial workers.**
- \* Ensure the remedy is compatible with existing and future records of decision for the site.**

## Summary of Remedial Alternatives

EPA developed eight remedial action alternatives, comprised solely or in some combination of the general response actions and technologies identified, screened, and retained in the feasibility study. After EPA screened the alternatives for effectiveness, implementability, and cost, Alternatives 1, 3, 4, and 5 were retained for detailed analysis and further consideration.

With the exception of Alternative 1, the retained alternatives presented here are expected to meet the remedial action objectives set forth for this cleanup action. Alternative 3 differs slightly, however, in that it reduces, rather than eliminates, the risk of an uncontrolled ARD release.

With the exception of Alternative 1, the retained alternatives presented here are also expected to comply with all Applicable or Relevant and Appropriate Requirements (ARARs), as required by Superfund law. ARARs include local, state and federal laws and requirements.

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### ***Alternative 1:***

- ***No Action***

Superfund requires that EPA retain this no-action alternative as a baseline for comparison to other alternatives. This alternative would require that current site operations be suspended and no further action be taken. ARD-contaminated water management and treatment would be discontinued, and contaminant sources such as acid-generating waste rock and fill would be left unaddressed.

This alternative is not protective of human health or the environment and does not comply with the Remedial Action Objectives or ARARs.

***Estimated Total Capital Costs: \$0***

***Estimated Total O&M Costs (50 years) : \$250,000***

***Estimated Construction Timeframe: Not Applicable***

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### ***Alternative 3:***

- ***Anchor Hill Pit ARD Collection***
- ***Water Treatment Plant Upgrade***
- ***Limited Fill Removal, Consolidation, and Cover***
- ***Land Use Controls***

Alternative 3 calls for upgrades to the water treatment plant as needed to allow concentrated ARD to be treated. The upgrades would allow concentrated ARD stored within the mine pits and ponds to be removed and treated.

This alternative would facilitate consolidation and containment of contaminant sources within Dakota

Maid Pit. This would address the risk of concentrated ARD potentially discharging through the pit back fills to the collection systems.

Alternative 3 emphasizes consolidation and containment of contaminant sources from the Upper Strawberry Creek corridor on a limited basis to reduce the volume of ARD collected for storage and treatment under OU2. Spent ore on the Heap Leach Pad would not be addressed. Acid generating waste rock and fills across the remainder of the site would not be addressed.

Land use controls would be implemented as needed to address risks posed to people from the unaddressed contaminant sources. Land use controls would include a combination of institutional controls, such as community awareness and land use restrictions, and engineered controls, such as posted warnings and fencing.

***Estimated Total Capital Costs: \$26,700,000***

***Estimated Total O&M Costs (50 years) : \$1,388,000***

***Estimated Construction Timeframe: Two Years***

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#### ***Alternative 4:***

- ***Anchor Hill Pit ARD Collection***
- ***Water Treatment Plant Upgrade***
- ***Partial Fill Removal, Consolidation, and Cover***
- ***Land Use Controls***

As with Alternative 3, Alternative 4 includes upgrades to the water treatment plant that are needed to allow concentrated ARD to be treated. The upgrades would allow concentrated ARD stored within the mine pits and ponds to be removed and treated. The Dakota Maid Pit and the Sunday Pit would then serve as repositories for site contaminant sources being consolidated and contained. Removing and treating the ARD stored in the mine pits and ponds would also reduce the risk of concentrated ARD from potentially discharging through pit back fills to the collection systems.

While Alternative 3 focuses solely on the upper Strawberry Creek corridor, Alternative 4 emphasizes site-wide consolidation and containment of all contaminant sources to reduce the volume of ARD collected for storage and treatment. Alternative 4 would address spent ore on the Heap Leach Pad as necessary to form stable slopes for containment. The additional caps and covers with Alternative 4 reduce the risk to people and the environment from direct exposure to site contaminants, as compared with Alternative 3.

Due to the expanded remedial work with Alternative 4, fewer land use controls would be required than with Alternative 3. Alternative 4 includes limiting use of contaminated groundwater and preventing damage to the mine waste caps.

***Estimated Total Capital Costs: \$51,965,000***

***Estimated Total O&M Costs (50 Years): \$1,635,000***

***Estimated Construction Timeframe: Three Years***

## **EPA's Preferred Alternative**

### ***Alternative 5:***

- ***Anchor Hill Pit ARD Collection***
- ***Water Treatment Plant Upgrade***
- ***Fill Removal, Consolidation, and Cover***
- ***Land Use Controls***

Overall, Alternative 5 would address contaminant sources similar to Alternative 4 by removing, consolidating, and covering waste rock and fills and covering selected, exposed bedrock sources. However, Alternative 5 would address the largest amount of contaminant sources by requiring that the majority of spent ore on the Heap Leach Pad be removed and contained within the Dakota Maid Pit and the Sunday Pit.

Upgrades to the water treatment plant would be performed as necessary to allow concentrated ARD to be treated. As with Alternatives 3 and 4, collection and treatment of contaminated water within the mine disturbance area would continue. Treated water would be discharged into lower Strawberry Creek as required under the OU2 Interim Record of Decision.

Land use controls with Alternative 5 would be the same as those described in Alternative 4. Due to the expanded remedial work in both Alternatives 4 and 5, fewer land use controls would be required than with Alternative 3. Land use controls would include limiting use of contaminated groundwater and preventing damage to the mine waste caps.

Alternative 5 is EPA's preferred remedial alternative for the Gilt Edge Mine. By addressing the largest amount of contaminant sources, it most comprehensively reduces ARD generation, limiting the amount of ARD requiring treatment. Alternative 5 would also reduce the infrastructure needed to capture and convey contaminated water to the water treatment plant, reducing long-term operation & maintenance costs. Another benefit of Alternative 5 is that it provides for the largest area for water treatment plant sludge disposal among the alternatives by using the area vacated by the removal of the Heap Leach Pad for sludge storage.

Alternative 5 reduces the risk to people and the environment from direct exposure to site contaminants more than Alternative 3. Alternative 5 provides the greatest protection to human health and the environment because it provides greater long-term protectiveness than both Alternatives 3 and 4 and greater implementability than Alternative 4. Please see the alternatives evaluation chart on the next page for further comparison among Alternatives 1, 3, 4, and 5.

***Estimated Total Capital Costs: \$58,541,000***

***Estimated Total O&M Costs (50 years) : \$1,550,000***

***Estimated Construction Timeframe: Four Years***

## Evaluation of Alternatives

EPA evaluates the final remedial alternatives retained for detailed analysis using nine standard criteria. The criteria fall into three groups: threshold, primary balancing, and modifying. Each alternative must meet the threshold criteria. The primary balancing criteria are used to weigh major trade-offs among alternatives, and the modifying criteria may be fully considered only after public comment is received on the Proposed Plan. The chart below presents the comparative analysis of alternatives against these criteria. Please refer to the Feasibility Study Report for a detailed summary evaluation of how the alternatives compare in this evaluation.

Summary of Comparative Analysis of Alternatives

Remedial Alternative	Description	Threshold Criteria		Balancing Criteria					
		Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Present Value Cost (Dollars)	
1	No Action	0	0	0	0	0	1	\$	\$220,000
3	Anchor Hill Pit ARD Collection/WTP Upgrade/Limited Fill Removal, Consolidation, and Cover/Land Use Controls	3	3	3	0	3	4	\$\$\$	\$24,831,000
4	Anchor Hill Pit ARD Collection/WTP Upgrade/Partial Fill Removal, Consolidation, and Cover/Land Use Controls	4	4	4	0	3	3	\$\$\$	\$46,268,000
5	Anchor Hill Pit ARD Collection/WTP Upgrade/Fill Removal, Consolidation, and Cover/Land Use Controls	4	4	5	0	3	4	\$\$\$\$	\$50,340,000

Threshold and Balancing Criteria (Excluding Cost)

- 0 None
- 1 Low
- 2 Low to Moderate
- 3 Moderate
- 4 Moderate to High
- 5 High

Balancing Criteria (Present Value Cost in Dollars)

- 0 None (\$0)
- \$ Low (\$0 through \$1M)
- \$ Low to Moderate (\$1M through \$10M)
- \$\$\$ Moderate (\$10M through \$50M)
- \$\$\$\$ Moderate to High (\$50M through \$90M)
- \$\$\$\$\$ High (Greater than \$90M)

## **Mark Your Calendar**

**The public has 30 days to comment  
on this Proposed Plan.**

**The public comment period runs:  
May 23 through June 23, 2008.**

**Feel free to submit your comments in writing  
via mail or email to:**

Jennifer Chergo  
Office of Communications  
and Public Involvement  
U.S. Environmental Protection Agency, Region 8  
1595 Wynkoop Street  
Denver, Colorado 80202  
(303) 312-6601  
1-800-227-8917, ext. 3126601  
chergo.jennifer@epa.gov

**Or, attend our public meeting to com-  
ment on this Proposed Plan in person:**

### **Gilt Edge Mine Superfund Site Public Comment Meeting**

**Tuesday, June 10  
6:30-8:30 p.m.**

**The Hampton Inn at the Four Aces  
531 Main Street  
Deadwood, SD 57732**

## **Contacts**

***For more information, please feel free to contact  
the following representatives:***

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***Or visit our Website at:***  
<http://www.epa.gov/region8/superfund/sd/giltedge>

***Or view documents at:***  
EPA Superfund Records Center  
1595 Wynkoop Street  
Denver, CO 80202  
(303) 312-6473

Hearst Public Library  
315 Main Street  
Lead, SD 57754  
(605) 584-2013